



Fermilab MTF

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Interlock Clearance Procedure For Test Stand 3

*At
The Development And Test Department
Of
The Technical Division*

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Revision Summary

| Revision | Revision Description | Date |
|-----------------|------------------------------------------------------------------------------------|----------------|
| 2.0 | Replaced Anded module in step 3.5 with Test Stand 2/3 Select module. Reworded 2.1. | March 25, 1999 |



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1.0 Introduction

This document describes a series of processes that must be utilized in an orderly manner to clear the safety interlock systems specifically for Test Stand 3 (High Temperature Superconducting leads) operations. We should also be able to recognize any fault or certain conditions that would prevent us from ramping the PEI power supplies in a safe manner. From this we should then be able to follow a clear cut path of corrective action. Illustrations of various interlock devices and a building layout are included at the end of this document. For those familiar with the cold measurement system and equipment, the items in **bold print** can be used as an outline.

2.0 Test Stand Set-Up

- 2.1 **Verify the dump switch is configured for Stand 3 operation.** At present, this must be validated with the IB#1 electrical safety officer (Jim Garvey). A fiber optic cable needs to be disconnected for stand 3 operation. It is anticipated that we will have a switch installed to accommodate this change.
- 2.2 **Verify that the bus plates are installed for Stand 3 operations.** These are located in the switchyard on the mezzanine. If the bus plates need to be changed, adhere to the P.E.I. Power Supply Lock-Out Procedure. *Please do not take the keys home!*
- 2.3 **Set the Stand 3 Lockout Switch to the Stand Enable position.** Each stand has a Stand Lockout Switch at the supply end of the stand. The stand to be tested should have the switch in the Stand Enable position. All other stands should have the switch in the Stand Lockout position. The exception to this rule is when a test stand other than stand 3 is undergoing hipots or 11 Hertz measurements. This example would require two switches in the Stand Enable position. If a buzzer sounds when placed in the enable position, then check the following:
 - 2.3.1 The Plexiglas safety enclosure must be in place. The Plexiglas panels are interlocked with 5 contact switches which present a 'No Go' when a panel is removed.
 - 2.3.2 At test stand 3, locate the Ground Switch Enable box. the switch lever should stay in the 'On' position. Since Hipot and 11 Hertz measurements are not applicable to this operation, the off setting will not be utilized for our purposes. Box is locked for service by electrical safety personnel only.
 - 2.3.3 The door to the Ground Switch Enable box also has a contact switch. If the door is ajar or the switch is bad, the buzzer will sound.

3.0 Test Stand Selection

For Test Stand 3 selection, please set the following switches in the control room:

- 3.1 Locate the P. E. I. Interlock Box (Trendler Box) in **rack #9** in the Control Room (Fig. 5). Set the Stand Select switch to **#0**. Disregard the stand select LEDs for this Trendler Box.
- 3.2 Locate the P. E. I. Interlock Box (Trendler Box) in **rack #10** in the Control Room (Fig. 5). Set the Stand Select switch to **#3**. The LED corresponding to the stand number should light up.
- 3.3 Locate the Stand Select box in rack #12. Set the Stand Select switch to **#2** and depress the black button. The stand number requested should then be displayed in the LED window.
- 3.4 Locate the Heater Interlock box in rack #10. Setting the toggle switch to the '**TS3 ONLY**' (up) position will activate the red 'BYPASS' LED.
- 3.5 Locate the unlabeled Test Stand 2/3 Select module in rack #11, Crate #3, Slot 6. **Setting the 3 toggle switches to the up position** will set the Quench switch to the TS3 position, the Slow Rmp Dn switch to the TS3 position and the bottom switch to the QLM Ph. Back position (Output And Mod for TS2).
- 3.6 Locate the Safety Circuit Delay (Dump Delay) module in rack #11, crate #2, slots 8 and 9. Set the toggle switch to the '**TS3 ONLY**' (up) position activating the red LED.
- 3.7 Locate the 'Test Select' panel in rack #10 and select '**QNCH TEST**'.

4.0 Interlock Box Clearance

The magnet test system is protected through a series of various interlock boxes which must be cleared in a systematic manner. Unless otherwise informed, assume these devices are in the control room.

- 4.1 **Reset the hardwire interlock box** located on the outside West wall of the control room as shown in Fig. 1. This drawing represents the box in a stand 3 enable position. Although some of these labels represent an obsolete system, their purpose is still functional.

4.1.1 The horizontal row of LEDs along the top represents the photo-electric cells used to monitor the bus plates in the switchyard. After pressing the top reset switch, all LEDs except those representing the stand under test should be illuminated as the bus plates break the beam. Occasionally (especially on stand 5-) a reflector will melt enough due to the heat to disrupt the beam. If this happens, immediately contact the power supply personnel.

4.1.2 The vertical row of LEDs in the middle section will indicate which stand is ready for testing. Only the indicator lamp corresponding to the stand ready for test should be illuminated. This section monitors the stand lockout switches, the test stand ground switches and the plunger switches located behind the bus plates in the switchyard.

4.1.3 Located next to the vertical row of indicator lamps described above are a series of numbered lights. For our purposes, only the number 9 lamp should not be illuminated. Following is a list of these indicator functions. Whereas we previously

used TransRex power supplies with 2 dump resistors, we now use PEI power supplies with one dump resistor.

1. Ground Fault
2. 5-TI Heartbeat. Although this label is no longer current in nomenclature, this is the cryo-system monitor that is tied to the TI-530 indicator panel in the control room.
3. Crash Buttons. See Fig. 7 for the 8 locations. **Never** press in a crash button to check if it has been activated. These are to be used for emergency only as the refrigerator system may be effected.
4. 10KA Holec, Platform SW's.
5. TSRX2, Dump 2 Ready. Our system now contains only one dump resistor, however, this lamp should still be activated.
6. Switchyard Cabinets 1, 2, 3. If this indicator does not light, check that the cabinet doors are closed securely and that the door switches are working properly.
7. TSRX1, Dump 1 Ready.
8. Switchyard Cabinets 4, 5, 6. If this indicator does not light, check that the door switches are closed securely and that the door switches are working properly.
9. TSRX 1 M-R Mode. Main Ring mode should not be activated.

4.1.4 On the right of the vertical row of indicators are 4 Permit indicators. These are labeled TRSX2, Dump 2, TRSX1, Dump 1. These labels are obsolete but the indicators are functional. The Transrex power supplies and the 2 dump resistors have been replaced with 2 PEI power supplies and one dump resistor. These indicators will activate when the Dump Switch and Dump Resistor Controller is turned on and reset and the power supplies are unlocked and in the ready position.

4.1.5 Of the 4 mode indicators at the bottom of the interlock box, only the Parallel P. S. Mode indicator should be activated.

- 4.2 Verify the Magnet Stand Interlock box (Fig. 2) is in the ready mode for stand 3. This box located at the top of rack #5 is considered expendable and is slated for future removal but until then is an integral part of the interlock procedure. All fault lights have been disabled for stand 3, thus the green indicator lamp should remain on. If not, depress the reset switch.

- 4.3 **Reset the TI-530 indicator panel** (Fig. 3) located in rack #4. The first, third, and fifth columns of indicators are red flashing No-Go switches which must be depressed to reset. The second and fourth columns are green Go switches which can be depressed to select a stand for hipot or 11 Hertz request. Also, the stand that is set up for test will be illuminated. The Magnet Not Ready interlock will not clear until all others are clear. Although many of these labels are again obsolete, this panel should be self-explanatory. If this panel does not seem to be working right, press the Lamp Test switch to check that all the lamps are working.

4.3.1 Note: One problem that has occurred in the past is a water flow problem. Although the flow may indicate enough to be sufficient, the interlock will not clear. One solution that has worked on occasion is to have an operator cycle the manual lead flow valves located at the top of the stairway adjacent to the control room.

- 4.4 **Reset the P.E.I. interlock box** (Fig. 5) located in rack #10 in the control room. This box is often referred to as the Trendler box in recognition of the designer of its

circuitry. All previously mentioned interlock boxes have to clear to reset this box. If all faults are corrected, the green light should appear a few seconds after resetting. One must recognize that certain fault labels are obsolete or outdated such as the TransRex temperature instead of the P.E.I. temperature. Also, Ross valves are no longer used. This problem should be remedied by the planned future removal of this device. Otherwise, the interlock faults should be apparent.

- 4.5 Additional indicator boxes are illustrated in Fig. 4 and located as shown in the building layout (Fig. 7).

5.0 Activate Power Supplies And Related Equipment

- 5.1 In the Northeast corner of the building, locate the rack containing the Dump Switch and Dump Resistor Controller. **Turn on the dump switch** at the top right corner of the rack. **Reset the red 'Local Reset' button.** The fault lights at the panel should clear and the light indicating the dump is charging should illuminate. It takes a few minutes for the dump to charge.
- 5.2 Locate the Dump Resistor also in the Northeast corner of the building and **verify the dump is set for 100 MilliOhms.** With the dump switch on, a red LED should indicate the resistance selection. At the present, all applications require 100 MilliOhms, however, for possible future applications, follow the 'Procedure For Changing The Taps In The New Dump Resistor'.
- 5.3 **Set the power supply time constant to 0.3** at the Master power supply. Although the time constant can be set at any time prior to taking good data, this is a convenient time. The time constant switch readout in the control room, rack 11, should display a 2.
- 5.4 Both blue PEI **power supplies can be unlocked, turned on and reset** at this time.
- 5.5 **Turn on both booster pumps** located across from the Master power supply.
- 5.6 Check the LCW (Low Conductivity Water) conductivity meter located at the top of the stairway adjacent to the control room (as shown in fig. 7). This meter typically reads about 8 megaohms. Measurements should not be attempted below 1 megaohm. The case for this instance occurring is very rare and need not be a routine check although one should be aware of this parameter.
- 5.7 **Reset the Power Supply Controller** located in rack #10. The fault lights on the adjacent Dump Switch Status Readout (Fig. 6) should be explicit. If this interlock procedure has been followed properly, one should then be able to reset and turn on the power supplies. This completes the equipment related portion of the pre-power setup. The computer controlled portion of the stand 3 interlock clearance procedure merits specific documentation.

Prepared By: Mark D Thompson, Magnet Measurer, April 8, 1998

Checked By:

Approved By:

Hardwire Interlock Box

Configured in Stand 3 Enable Position

Located on Outside West Wall of Control Room

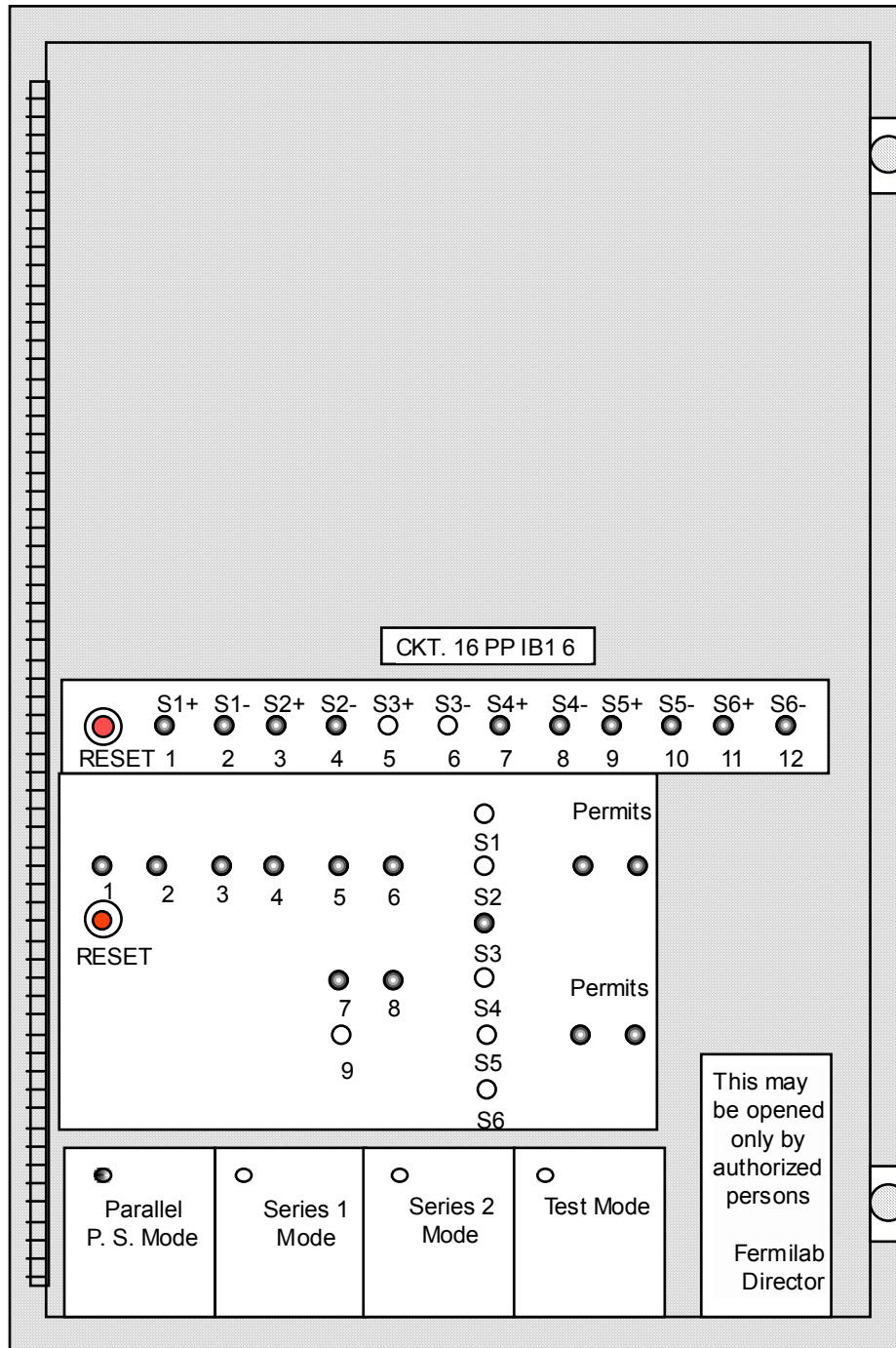


Fig. 1

MAGNET STAND INTERLOCK BOX

Located at the top of Rack #5 in the Main Control Room

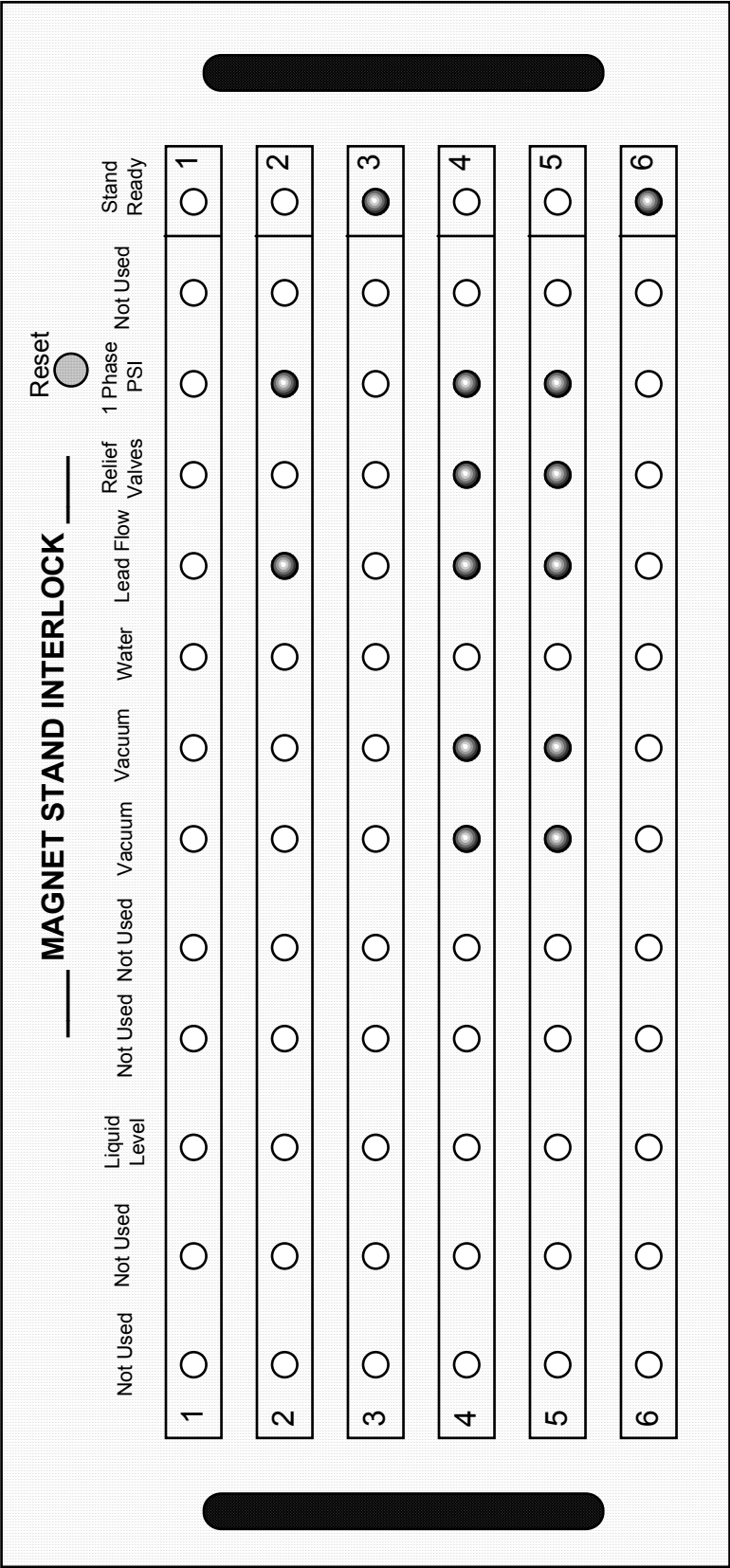


Fig. 2

TI-530 INDICATOR PANEL Located in Rack #4 in the Control Room

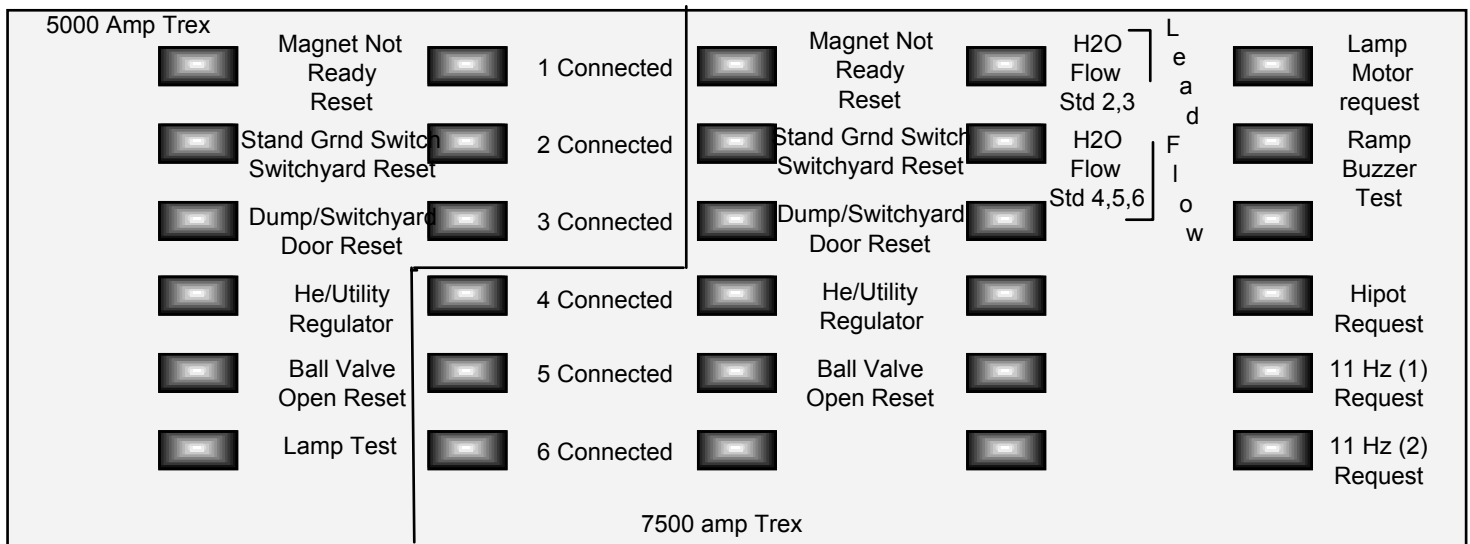


Fig. 3

INTERLOCK INDICATORS

Northeast corner of IB1 next to Dump Controller

On Mezzanine above Switchyard

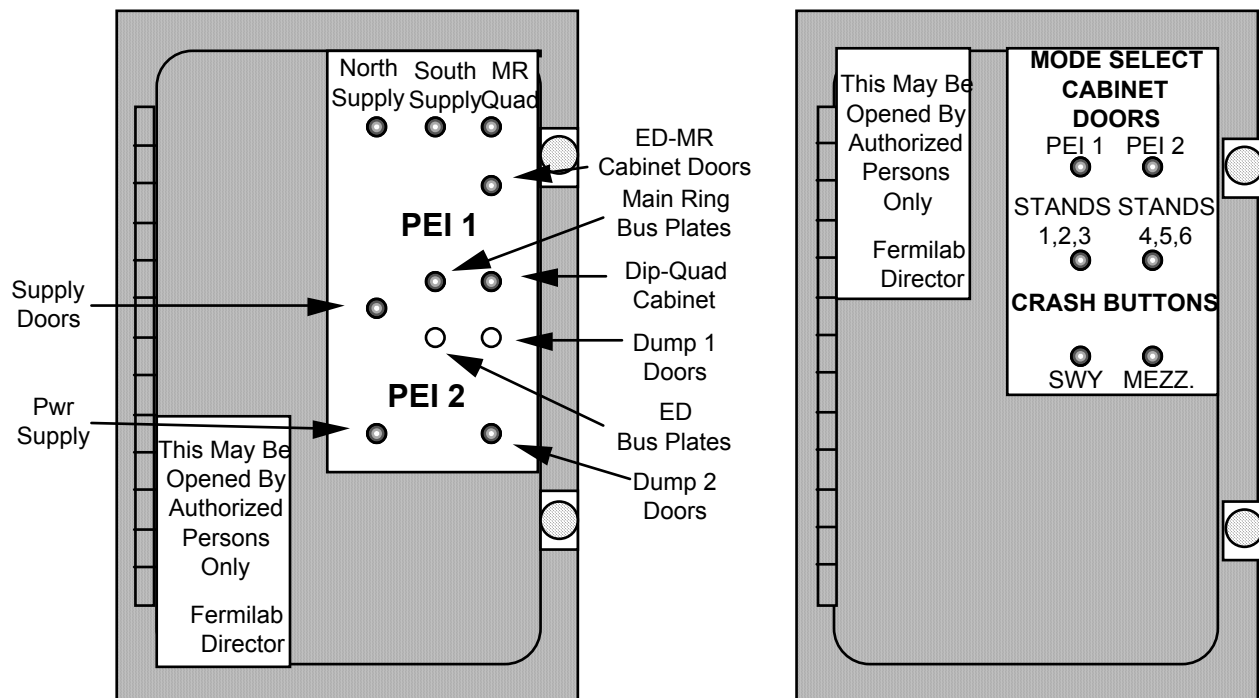


Fig. 4

P. E. I. INTERLOCK BOX

Located in Rack#10 in the Control Room

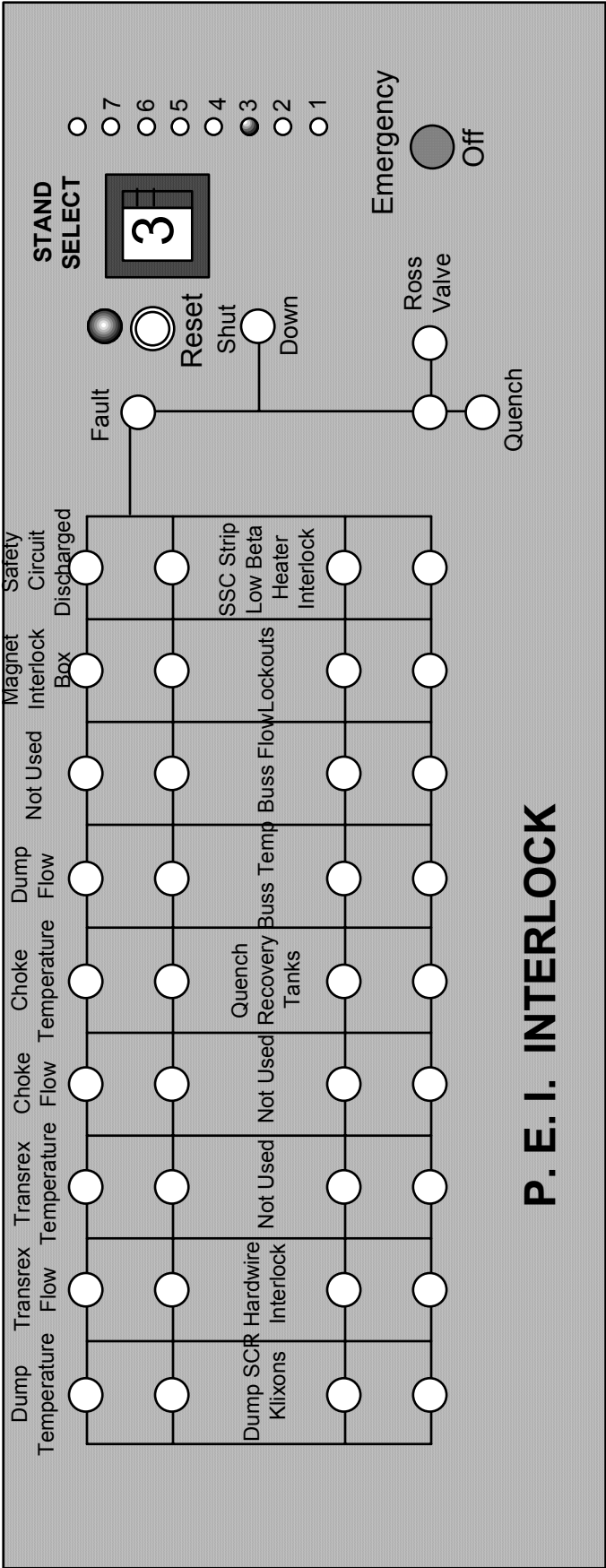


FIG. 5

Dump Switch Status Readout

Located in Rack #10 in the Control Room

| Dump Switch Status Readout | |
|----------------------------|-------------------------|
| ● Ext. Ref. | ● P.S. 1 Ref |
| ● P.S. 1 Ready | ● P.S. 2 Ready |
| ● Resistor Tap | ● MTF Intlk |
| ● Intlk Complete | ● Resistor Overcurrent |
| ● Resistor Overtemp | ● Resistor Tap Limit |
| ● Capacitor Charge | ● Capacitor Pressure |
| ● Switch Overtemp | ● Switch Leak |
| ● SCR Gate Pwr | ● Dump Intlk |
| ● Dump Failure | ● Run SCR Current Limit |
| ● P. S. Overcurrent | ● Lead A Flt |
| ● Lead B Flt. | ● Quench Flt |
| ● Intlk Flt | ● Local Dump |
| ● MTF #1 Flt | ● MTF #2 Flt |
| ● MTF #3Flt | ● Crowbar On |
| ● Filter Overtemp | ● Choke Overtemp |
| ● Spare | ● Spare |
| ● Spare | ● Spare |

Fig. 6

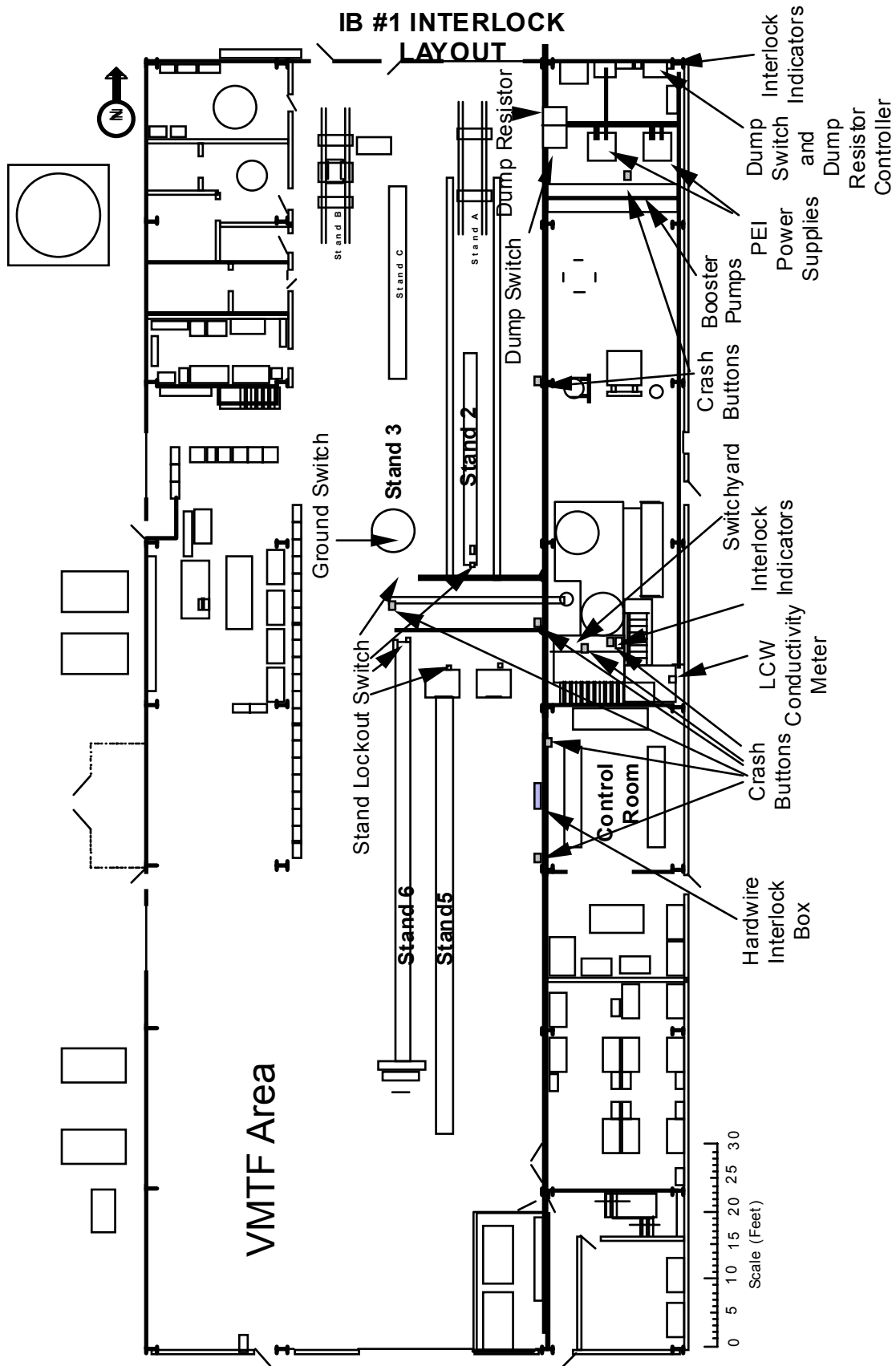


FIG. 7